MILITARY STANDARD

TEST METHOD FOR PAVEMENT SUBGRADE, SUBBASE, AND BASE-COURSE MATERIALS

TO ALL HOLDERS OF MIL-STD-621A

1. Make the following pen and ink changes:

2. Transpose the title to read as above.

General Data Section.

Page 2, paragraph 2.2: Delete "Nongovernmetal" and substitute "Nongovernmental."

Page 2, paragraph 2.2: Add: "ASTM D653—Terms and Symbols Relating to Soil Mechanics."

Page 3, paragraph 3.1: Delete "Not Applicable." and substitute "Terms and Symbols Relating to Soil Mechanics. See Reference Document ASTM D653."

Page 5, under "Review interest", after "Army—MO" add "CE".

Method 101. California Bearing Ratio of Soils.

Page 1.

Paragraph 2.2: Delete "100-1." and substitute "101-1."

Paragraph 2.4: Delete "100-1." and substitute "101-1."

Paragraph 2.9: Delete "Compaction apparatus." and substitute "General equipment."

Page 2.

Paragraph 3.1.1, change to 3.1.1.1, and delete from the end of the first sentence: "(30 lb. for field test)."

Paragraph 3.3: Delete "CBS" and substitute "CBR".

Paragraph 3.3.1, line 2: Delete "CBCS" and substitute "CBR". Delete the third sentence.

Page 3.

Paragraph 3.2.1: Delete "3.2.1" and contents to paragraph 3.3.2.

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Page 4.

Paragraph 3.4: Between "fig." and "101–6", insert "101–5 and".

Paragraph 3.4.1.2, line 6, between "agreement," and "additional": Insert "three".

Method 103. Liquid and Plastic Limits of Soils.

Page 2.

Paragraph 2.11, between subparagraphs (c) and (e): Insert: "(d) Tabulated flask (*see* fig. 103–2)."

Page 5.

Paragraph 4.1.5, delete "b" from b4.1.5".

Paragraph 4.1.10, line 5: Delete "originates" and substitute "ordinates".

Method 104. Modulus of Soil Reaction.

Page 2.

Paragraph 3.1.1, between lines 5 and 6: Insert: "or confining effects. If the subgrade is to be".

Page 3.

Paragraph 3.3.1, lines 10, 13, 17, 19, and 22: Delete the apostrophes from the symbols "K_u" and substitute prime marks.

Page 4.

Paragraph 3.3.2: Delete from the formula the "X" w h i c h is between the symbol "K_u" and the rest of the formula. Place a prime mark on the symbol "K_u".

3. The following pages of MIL–STD–621A have been revised and supersede the pages listed:

Test method	New page	Date	Superseded page	Date
	V	1966	V	22 Dec 1964
103	3–4	1966	3–4	22 Dec 1964
103	8	1966	8	22 Dec 1964

4. Retain this notice and insert it before the table of contents.

CONTENTS

Supersedes page V of 22 December 1964.

3.3.4 Lift the sieve above the soil and water in the pan, and wash the remaining material with a small amount of water until the wash water is completely clear.

3.3.5 Transfer the material retained on the No. 40 sieve to a clean pan, and place another increment of the soaked sample on the sieve.

3.3.6 Repeat this process until all of the soaked sample has been washed.

3.3.7 Dry the material retained on the No. 40 sieve in an oven, and then dry sieve it on the No. 40 sieve. Add the material passing the No. 40 sieve in this sieving to that already washed through the No. 40 sieve.

3.3.8 Prepare the minus 40 fraction for testing by one of the following methods:

(a) Set the pan containing the wash water and minus No. 40 fraction of the sample aside, and do not disturb until all the soil particles have settled to the bottom and the water above the soil is clear. Decant, siphon, or wick off as much of the clear water as possible. For soils containing dissolved salts and those in which the wash water will not become clear in a reasonable time, the water must be removed by evaporation, using an oven or heat lamp, until the soil reaches a moisture content that appears likely to be just above the liquid limit. During the evaporation process, stir the soil frequently to prevent over-heating. Chemicals may not be added to hasten the settlement of the fines.

(b) Use a No. 3, 11 cm J. H. Munktell, No. 604 or 597 S&S, or No. 1 or 3 Whatman filter paper in a Buchner funnel mounted in a tubulated flask, and filter the minus No. 40 fraction of soil from the wash water by applying high vacuum to the flask.

(c) Select a series of filter candles (as many as 4 and not less than 2) for attachment to a small manifold. The candles should be approximately 1 inch in diameter and approximately 8 inches long and should contain a glazed ceramic nipple and top section. The pore radius of the candle should be commensurate with the soil type being tested. For example: if the sample is a base course with a small amount of fines, a pore radius of 50 microns should be used. For the finest material, a pore radius of about 5 microns is used; a 20-micron pore radius is recommended for universal use. After the proper candles have been selected, attach them by hose to a small manifold which in turn is placed on the top of the tabulated flask (see fig. 103-2). Then establish a vacuum, either through a vacuum pump or by use of a water-jet-type filter pump, and apply it to the tubulation to create a vacuum within each filter candle. Prime the filter candles with water and lay them in the bottom of a rectangular metal container. Pour the washed sample, usually contained in a gallon jar, onto the filter candles as vacuum is applied to them through the ma-

fold and hose. Before the unwashed samples are poured, and in order for the soil to assist in the filtering process, spoon the sand sizes that have quickly settled in the bottom of the jar onto the top of the filter candles and

(d) Alternate method. A rapid reduction of the moisture content of the sample, after removal of excess water by wicking or siphoning, can be effected by spreading the slurry to a depth of about 1/4 inch in a dry plaster of paris mold. The soil loses moisture through absorption by the mold until it reaches the desired consistency. The sizes and shapes of the molds for processing samples vary widely, the optimum size depending primarily upon the kind of material and size of sample to be processed. Molds are easily cast in the laboratory using laboratory pans for both internal and external forms. Pans should be lightly greased with petroleum jelly to permit their easy removal after molding. The molds may be cleaned after use by wiping them with a moist sponge or rag. They should then be air dried for several days before reuse. Placing the moist mold in an oven to hasten drying often causes it to fall apart.

4. TEST PROCEDURE

4.1 Liquid limit test.

4.1.1 *Definition.* The liquid limit of a soil is the moisture content expressed as a percentage of the weight of the oven-dry soil, at which two halves of a soil cake will flow together for a distance of 1/2 in. along the bottom of the groove separating the two halves in a liquid-limit test cup, when the cup is dropped a distance of 1 cm (0.3937 in.) 25 times at the rate of 2 blows per second.

4.1.2 *Sample.* Take about 100 g from the thoroughly mixed portion of the material passing the No. 40 sieve (prepared in accordance with the method described in 3.3.).

4.1.3 *Adjustment of mechanical device.*

4.1.3.1 Inspect the liquid limit device to determine that it is in good working order, that the pin connecting the cup is not worn sufficiently to permit side play, that the screws connecting the cup to the hanger arm are tight, and that a groove has not been worn in the cup from long usage. Inspect the grooving tool to determine that the critical dimensions are as shown in figure 103-1.

4.1.3.2 By means of the gage on the handle of the grooving tool and the adjustment plate A, figure 103-1, adjust the height to which the cup B is lifted so that the point on the cup that comes in contact with the base is exactly 1 cm (0.394 in.) above the base. Secure the adjustment plate by tightening the screws, C. With the gage still in place, check the adjustment by revolving the crank D at a rate of 120 revolutions a minute. If the adjustment is correct, a slight click will be heard each time the crank is turned. If the cup is raised off the gage or no sound is heard, make further adjustments.

4.1.4 Place a portion of the thoroughly mixed soil sample in the cup over the spot where the cup rests on the base, and squeeze and spread it into the position shown in figure 103-3 with as few strokes of the spatula as possible, taking care to prevent the entrapment of air bubbles within the mass. With the spatula, level the soil and at the same time trim it to a thickness of about 8 mm at the point of maximum thickness. Return excess soil to the evaporating dish. Divide the soil in the cup with a firm stroke of the grooving tool along the diameter through the centerline of the cam follower so that a clean, sharp groove will be formed (see fig. 103-3). Sandy or flaky soils may require several strokes of the grooving tool to avoid tearing the sides of the groove. Increase the depth of the groove with each stroke, and with the last stroke scrape the bottom of the cup clean. Make the groove with as few strokes as possible.

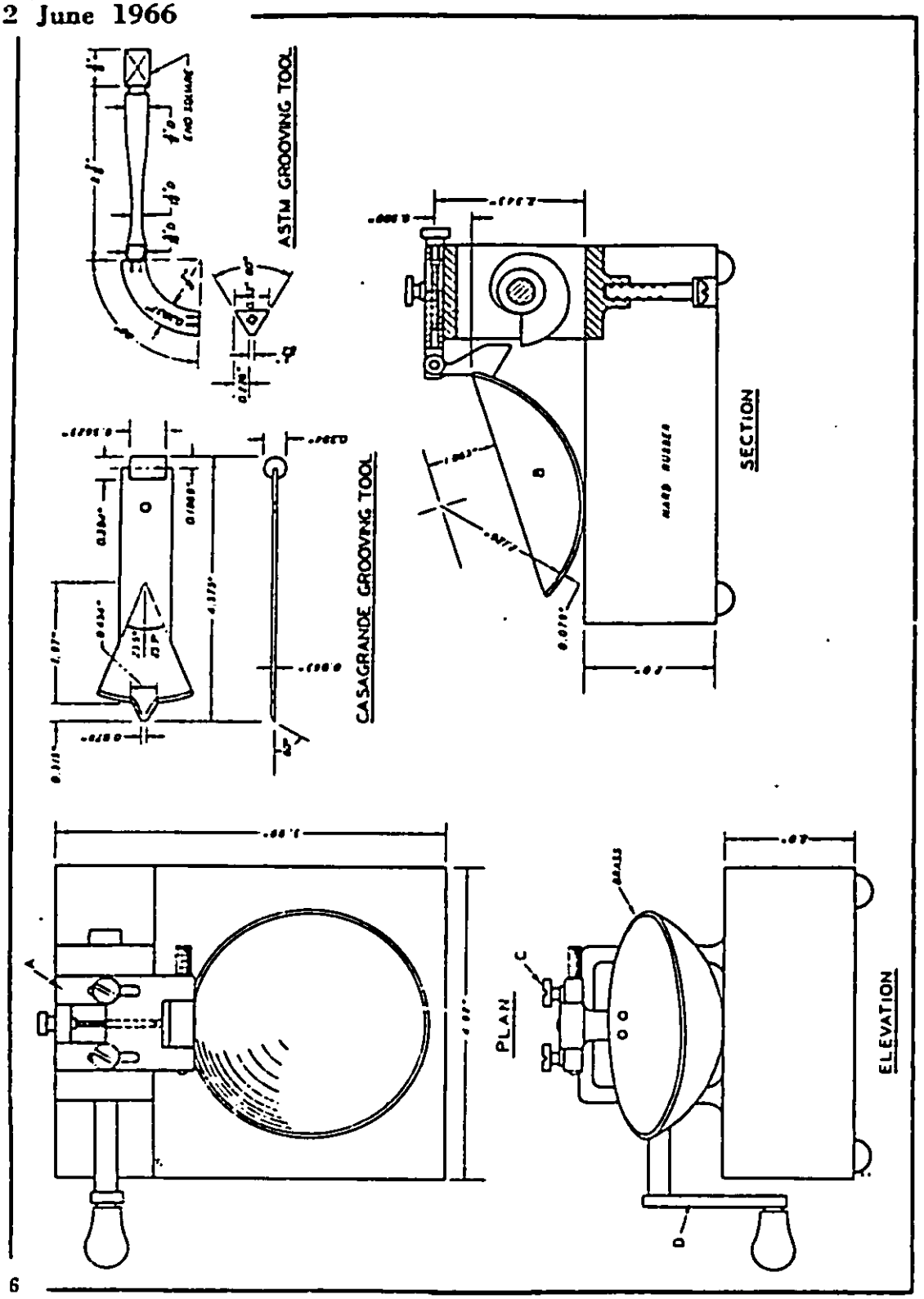

FIGURE 103-1. Mechanical liquid limit device